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(21) Application No 8116482      (54) **Production of building board by the take-up method**

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(57) A building board is manufactured by the take-up method, using ground cellulosic and/or wastepapér fibres as carrier fibres, waste gypsum in dihydrate form as a filler and hydraulic cement as a bonding agent. Optional additives such as blast furnace slag are also described.

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**SPECIFICATION****Production of building board by the take-up method**

The present invention relates to the production of building board by the take-up method, using ground cellulosic and/or waste paper fibers as carrier fibers in the wet pulp for building board, waste 5 gypsum in dihydrate form as the filler, and hydraulically setting cement as the bonding agent, as well as additives.

From British Patent 1,584,046 it is known to produce asbestos-free building board by the take-up method, in which there are used unbeaten, or unground, cellulosic and/or waste paper fibers as carrier 10 fibers in the wet pulp, cement as the bonding agent, and in addition to certain other materials, gypsum, which at the early stages of the process is in part or entirely in the form of semi-hydrate. According to the method, the process is, however, allowed to continue until practically all of the semi-hydrate is converted to dihydrate before the wet pulp is taken up as board.

The object of the present invention is to use waste gypsum for the production of fire-resistant 15 building boards by the take-up method. Gypsum waste is becoming a real problem, since in certain branches of industry, such as the phosphate industry, it is produced in millions of tonnes. Exploitation of such an amount of waste is of great economic significance.

Attempts have been made even previously to use waste gypsum for the production of asbestos-free building boards by the take-up method. However, this method has not been successful when only unground carrier fibers have been used, since such fibers do not keep the ingredients of the wet pulp, especially waste gypsum and the bonding agent, evenly cohesive. Cohesion is, however, necessary, especially when the take-up method is used.

It has been observed in experiments that specifically the grinding of cellulosic fibers enables waste gypsum to be used in building boards, even though waste gypsum itself is not a bonding agent. Grinding causes 'felting', i.e. a structure in which the fibers, adhering to each other, form cavities. When these 25 cavities are filled with some compressed material, which need not be chemically bonded, a surprisingly rigid structure is produced. This material can be waste gypsum, which thus serves only as a filler. This phenomenon can be due to surface forces effective between the particles, the Van der Waal force or other similar forces, which keep the particles cohesive in the cavities. Very good boards, suitable for interior surfacing, can be produced by this method.

30 The mechanism which keeps the board cohesive is not precisely known. Of course, the strength of the building board thus obtained is not as high as the strength of board produced using known bonding agents; nevertheless, it is surprisingly good. However, as such the board is not waterproof but dissolves in water. For this reason, an amount of hydraulically setting cement must be added to the pulp. The purpose of the cement is thus not to produce a structure which enables forces to be transmitted, since 35 this is already achieved by means of the ground cellulosic fibers and waste gypsum. Since the purpose of the cement is only to prevent the board from dissolving, its proportion can be minimized. The amount of cement is, of course, substantially dependent on the other ingredients used, especially the waste gypsum.

By proportioning the degree of beating of the fibers and the amounts of gypsum and cement in 40 relation to each other in the correct manner found through experiments, a board is obtained which is waterproof and has satisfactory strength properties. Since the proportion of cement can be minimized, the proportion of gypsum, which is important in terms of fire-resistance, can be maximized. In this manner a use has also been found for waste gypsum.

According to the present invention, when building boards are produced from waste gypsum, 45 beaten cellulosic and/or waste paper fibers are used as carrier fibers, the degree of grinding must be relatively high, 20—75 °SR (Schopper-Riegler). The proportion of hydraulically setting cement is selected between 15 and 50% of the total weight of the dry matter of the board. The proportion of cement to be used depends on the degree of grinding of the cellulosic fibers. Since uncalcinated waste 50 gypsum does not bond hydraulically, the use of cement is important. In the method according to the invention, it is also important that the degree of grinding of the carrier fibers and the amounts of gypsum and cement are proportioned to each other in an advantageous manner in order to achieve optimal results. The cement can be Portland cement.

The characteristics of the invention are given in the accompanying claim. According to it, blast-furnace slag and fly dust, as well as diatomite, perlite, vermiculite, pulverized limestone or the like, 55 mineral fibers, glass fibers, glasswool, rockwool and slagwool or the like, and organic fibers such as sisal, hemp and plastic fibers or the like, and flocculants are used for the building board in addition to the previously mentioned substances, in the proportions indicated in the claim.

Building board which has been produced by the method according to the invention and in which uncalcinated waste gypsum is used has fully satisfactory strength properties, even though all of its 60 strength values are not of the same order as those of boards previously produced.

By the method according to the invention it is, of course, also possible to manufacture building boards in which the basis material is uncalcinated raw gypsum instead of waste gypsum.

The following table shows, for comparison, some test results illustrating the strength properties of building boards produced by the method according to British Patent 1,584,046 and the strength

properties of building boards produced by the method according to the present invention.

	Composition	Density kg/m <sup>3</sup>	Bending strength N/mm <sup>2</sup>		Impact strength Nmm/mm <sup>3</sup>		Comments	5
			Perpen- dicularly to the direction of the run	In the direction of the run	Perpen- dicularly to the direction of the run	In the direction of the run		
5	Cellulosic fibers	15%						
10	Gypsum, as fed semi-hydrate	50%	1119	9.6	19.3	3.4	7.0	10
	Cement	35%						
	Cellulosic fibers	15%					GB-PS 1,584,046	
15	Gypsum, as fed semi-hydrate	42%	1113	12.2	26.1	2.5	5.7	15
	Cement	15%						
	Mineral additives	28%						
	Cellulosic fibers	10%						
	Waste gypsum	60%	1415	13.6	16.8	2.1	3.1	
20	Cement	30%					The present invention	20
	Cellulosic fibers	10%						
	Waste gypsum	60%	1311	15.4	19.2	2.3	3.5	
	Cement	10%						
	Slag	20%						

## 25 CLAIMS

1. A building board manufactured by the take-up method, comprising ground cellulosic and/or wastepaper fibres, waste gypsum in dihydrate form and hydraulically setting cement. 25
2. A building board according to claim 1 wherein the fibres have a degree of grinding of 20—75° Schopper-Riegler.
3. A building board according to any preceding claim wherein the gypsum constitutes 20 to 80% by weight of the dry matter of the board.
4. A building board according to any preceding claim wherein the cement constitutes 10 to 50% by weight of the dry matter of the board.
5. A building board according to any preceding claim wherein the fibres constitute 5 to 30% by weight of the dry matter of the board.
6. A building board according to any preceding claim comprising blast furnace slag or fly dust in an amount not more than 50% by weight of the dry matter of the board.
7. A building board according to any preceding claim comprising diatomite, perlite, vermiculite, pulverised limestone or the like, in an amount not more than 50% of the dry matter of the board.
8. A building board according to any preceding claim comprising mineral fibre in an amount not more than 15% of the dry matter of the board.
9. A building board according to any preceding claim comprising organic fibre in an amount not more than 15% of the dry matter of the board.
10. A building board according to any preceding claim comprising flocculant in an amount not more than 200 ppm of the dry weight of the board.
11. A building board substantially as hereinbefore described.
12. A process for the manufacture of a building board according to any preceding claim by the take-up method.

13. A process for the production of building board by the take-up method, using ground cellulosic and/or wastepaper fibres as carrier fibres in the wet pulp for the board, waste gypsum in dihydrate form as the filler, and hydraulically setting cement as the bonding agent, as well as additives, the ingredients being used in the following proportions, calculated from the total weight of the dry matter of the board:

5	waste gypsum in the form of $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$	20—80%	5
	hydraulically setting cement	10—50%	
	blast-furnace slag, fly dust	at max.	50%
	diatomite, perlite, vermiculite, pulverized limestone, or the like	at max.	50%
	cellulosic and/or wastepaper fibres, degree of grinding 20—75 °SR		5—30%
10	mineral fibres, glass fibres, glasswool, rockwool, slagwool, or the like	at max.	15% 10
	organic fibres: sisal, hemp, plastic fibres or the like	at max.	15%
	flocculants	at max.	200 ppm

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